Result Page

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LASER MICRO THESE SECTION SYSTEM the current invention concerns a laser micro these section system to the processing of a biology schen or also non-biological measures, in particular a laser micro these section system to the processing, separation and/or recovery of microscopic small biological and/or non-biological objects of a biological and/or. non-biological mass.

A such conventional laser micro these section system of the applicant is for example from the WHERE 97/29355 A or WHERE 01/73398 A known. With the laser micro these section systems written in these documents can become single biological or non-biological objects, which on a planar carrier disposed is, computer-aided selected and with a laser beam machined. A selected object can become from the ambient measures for example with the help of the laser beam computer-aided separated, in order to prepare the selected in each case object from the ambient measures free to. Subsequent one can do that free prepared object by a laser-induced transportation process with the help of a laser shot, which on the free prepared object directed becomes, of which carriers to a catching pre direction is catapulted. As carriers for example a polymer film can become used.

The before described method the possible separation, assortment and recovery both of biological objects and

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also of non-biological objects. In the frame of the vorlie genden patent application the bottom term becomes " biological objects " above all living or fixed biological cells or cell components understood, which component of a liquid or solid biological material, like example wise of a cell fabric, a smear or a Zellkul door etc. are. With the help of the before described method the selected in each case objects targeted with a selected substance by contactless laser microinjection loaded and the subsequent successful inji zierten biological objects can be segregated. Biology schen objects can on a solid planar carrier applied be next to each other, whereby the procedure of separating can become in nerhalb short time and contactless performed. Survivability and/or. the morphology biolo of the gischen objects becomes ensured, D. h. the biological whether it did not jekte becomes by the micro injection procedure and by Abtrenn-und catapulting process damaged and/or. beein trächtigt.

In principle the before explained laser-induced trans haven process, D can. h. the out catapulting single before SE of lektierter objects from the ambient in each case mass, also oh ne preceding free preparation of the selected in each case whether jekts take place, if the laser energy and/or the laser focus select in such a manner ge for the moment setting the separate laser shot become and/or. selected become that the impetus of this laser shot resultant from it is sufficient for extracting entspre the chenden object from the ambient mass and for the trans haven procedure to the collector.

Since the before described method can become wändig manual only relative up with the desired precision performed, the laser micro these section systems of the above documents are computer-aided designed, D. h. the out

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cut and/or a catapulting of a selected object made computer-aided, so that the laser light source, which the laser beam generated, automatic driven and the relative movement between the laser beam and that, required serving for cutting and/or catapulting, for cutting and/or catapulting, the biological and/or. not-biological objects exhibiting carrier automatic effected and controlled becomes. In particular is a computer-aided selection and/or. Mark of the desired objects possible located on the carrier, so that these subsequent automatic with the laser micro these section system machined to become to be able. The laser micro these section system covers for this a screen and/or. Monitor, becomes shown on which a video image of the material located received of a digital camera on the carrier. The user can on the screen and/or. a desired cut curve draw, which subsequent computer-aided automatic with the laser beam is after-driven, in order to cut the thus selected object out for the video image for example with the help of corresponding Grafiktools. In similar way can on the screen and/or. on the video image also a desired object for out catapulting marked becomes, whereby the subsequent separate laser pulse and/or. Laser shot at the desired location set becomes.

Although is already fundamental given with the before explained known laser micro these section systems a computer-aided and automated processing of the material located on the carrier, nevertheless the processing of a variety of biological objects, which in particular different type can be, is relative aufwändig, since the objects either only single or in its entirety machined to become to be able.

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The current invention is the basis the object to make a laser micro these section system available of the before described type with which the user friendliness and function variety are improved.

This object becomes according to invention by a laser micro these section system with that features of the claim 1 dissolved. The Unteransprüche define prefered in each case and favourable embodiments of the current invention.

The current invention becomes subsequent on the basis cutting and/or catapulting biological objects described. The invention is however just as more applicable for non-biological objects (dead matter), whereby it itself z. B. around microscopic small objects from glass, Silica, plastic etc. or artificial prepared vesicles etc. in a biological mass to act can. Likewise the current invention on non-biological masses or materials is, z. B. Polymer masses or. such a thing, more applicable, from which microscopic small objects are to be extracted with the help of the laser micro these section system.

The laser micro these section system according to invention covers a laser light source to the generation of a laser beam, which is to be directed toward the material which can be worked on located on a corresponding carrier. The other one an image pickup device, for example is provided with a CCD camera, which Video-bzw. Image on the carrier located of the material generated and on an indicator device, for example a screen, the laser micro these section system represents. This image will in each case select and the corresponding groups of objects to assign will be able the desired objects which can be worked on with the laser beam with an user interface of the laser micro these section system superimposed, in order. The laser

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Mikrodissektionsystem covers control means for evaluating the user selection thus accomplished and for providing a list, in which the selected objects with an indication or a designation are in such a manner contained of the associated in each case group of objects that bottom orientation at the object group specification a large selection of the objects and/or a object-group-specific selection for a subsequent processing with the laser beam are possible. These control means are in particular in a PC computer or a computer of the laser micro these section system implemented.

The selection and the association of the desired objects which can be worked on with the laser beam different marking types the user become provided for the order, so that the user specifies the desired in each case object on the indicator device computer-aided for example by corresponding choice of the mark on the one hand and assigns on the other hand the simultaneous corresponding group of objects, whereby each group of objects is another mark assigned. So for example the user different colors for the mark of the desired objects can become offered, whereby the user with the help of corresponding graphic expedients z. B. a cut line for a biological object on the indicator device in the desired color, which can be cut out, to draw can. In this way it is possible cells in a first color and tumor cells for example healthy on the indicator device in a second color to labeled, whereby summarized in the list created of the control means the single objects become after colors sorted and. By selections of a group of objects (which of the control means on the indicator device becomes preferably displayed with the corresponding color) is it then possible, everything this group of objects of
top associated objects automatic, D. h. computer-aided to work on whereby the corresponding objects successively started and with the help of

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the laser beam for example cut and/or to be out-catapulted. Of course also every other type of distinctive mark is possible in place of the mark by means of different colors. So for example a cut line with an unique Identifier, which becomes the desired in each case group of objects of identified, drawn on the video image around a desired object, superimposed etc., can.

The selection of the objects which can be summarized in a group of objects can take place as described both manual by means of the operator and automatic and computer based with digital image processing/Bildauswertung, whereby in the case secondarymentioned for example in actual known way by fluorescence evaluation or such a thing between healthy cells or tumor cells etc. distinguished will take place and an association to a corresponding group of objects of automatic can. The term selection means used herein covers thus both a manual selection and one software or computer controlled automatic selection of the desired objects.

By the before described proceeding it is possible to work on the before selected and marked objects with the laser beam group-specific. D. h. for example first all can become a first group of objects of associated objects with the laser beam machined, while subsequent then everything becomes a second group of objects associated objects machined. This possible that all objects of the first group of objects in a first receptacle and all objects of the second group of objects in a second receptacle after execution Schneideund/or catapulting procedure collected to become to be able. With the objects of the first group it can itself like already mentioned actualfor example around tumor cells act, during it

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with the objects of the second group for example healthy cells to concern can. The separation of the desired objects becomes in this way accelerated for the user significant simplified and.

Favourable way can become due to the group-specific Laserbearbeitung for each group of objects a different laser mode of handling selected and adjusted.

For this several different laser functions become the order provided of the laser micro these section system, whereby in particular also can become selected for each group of objects the separate number of the repetitions of the preset LaserBearbeitung.

An indication of the number of the objects contained in it as well as the total area of the objects contained in it preferably covers the list generated of the control means of the laser Mikrodissektionssytems, are the summarized by groups of the user selected objects in which before, for each group. For this the laser micro these section system with an automatic flat computation function is provided, which possible that becomes calculated after drawing a cut line around a desired object the automatic surface thus of the selected object enclosed of this cut line. In this way the user important additional informations become over the machined object-divided after the respective object group to the order provided.

Beside the before explained list section preferably also a list section becomes generated and shown of the control means, which informations contain over each single object, on the indicator device, over the respective object type, which can be

worked on, over the respective object-flat and/or over the group of objects assigned in each case

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can. Regarding the object type for example distinguished can become whether it concerns an object defined by a cut line or only around an object defined by one point of catapulting etc. Within this list section each single object can and/or. any selection of the represented objects marked will, in order to be able to work on the corresponding marked objects subsequent common with the desired laser function.

The list generated of the control means knows alternatively also only the first mentioned list section, are summarized object-by groups in which the selected objects, or only the list section secondarymentioned, in which the single selected objects are contained, exhibit. Important one is however that in each case an object group specification is provided, in order to make an other selection possible on the basis the object group specification.

The list created of the control means and/or. the object information contained in it can in a suitable storage medium and/or. in the working memory of the laser micro these section system stored become. About it is favourable to specify for the selected objects a reference position on the corresponding carrier on which itself the respective object positions of the selected objects relate, so that with a later processing of the corresponding carrier and with loadings of the stored object information on the basis of the reference position specified before simple starting and discovery relative of the for this stored object positions possible are.

The summary of the selected objects in groups of objects of possible also that after the Laserbearbeitung of the objects of a certain group of objects the positions of the corresponding objects on the slide again successively ange

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will drive, in order to examine proper cutting out or catapulting of the corresponding objects, whereby this can take place both via the operator visual via examination cut or of the catapulting lines on the screen and automatic via computer based evaluation cut or of the catapulting lines by means of digital image processing or image analysis.

As laser source of the laser micro these section system a pulsed UV laser becomes preferably used. As carriers a glass slide can become used, which can be preferably with a carrier foil, existing from an UVabsorptive polymer film with a thickness between for example 5 over and 15 over, coated, whereby the absorption behavior of the carrier foil is to the wavelength of the UV laser adapted and thus preferably possesses in the environment of the laser wavelength an absorptance maximum. Likewise tensioned carrier foils can and/or as carriers on frames. Inertial diaphragm or also teflon diaphragm in the form of Petrischälchen so mentioned etc. used become. As collector to the collection and/or. Takes up from objects extracted from the material which can be worked on can a catching substrate used become, which can be in form of a film or a plate or in form of a topfförmigen container formed. In particular micro centrifuge containers become recommended as collector, as they become used in the molecular biology, or the covering caps ("Caps") of it whereby in particular several such receptacles can be next to each other disposed, in order to be able to carry successively different objects into different receptacles. Likewise for example the use of a microtiter plate with a plurality of recesses ("Wells") is possible as collector, so that successively several objects can be caught by different recesses. The collector can provide with an adhesive layer

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its, so that extracted objects by the adhesive layer fixed to become to be able. Preferably a computer-aided controllable adjusting device is provided, in order to make an automatic positioning possible of these units for the carrier and/or the collector.

The function of the before explained control means according to invention is in particular by software in form of a corresponding control programme for the laser micro these section system implemented. The current invention concerns thus not only the laser micro these section system as such, but also the embodiment of the corresponding control programme and/or. the computer-readable storage medium, which stores this control programme.

The current invention becomes subsequent more near bottom reference on the accompanying drawing on the basis prefered embodiments explained.

Fig 1 points the structure of a laser micro these section system in accordance with a prefered embodiment of the current invention, fig 2 shows the illustration of an exemplary screen image in fig of 1 laser micro these section system shown to the selection and mark of desired biological objects, and fig 3 shows exemplarily a screen representation of the laser micro these section system with a list, shown in fig 1, in which by an user selected and marked biological objects are contained before.

The laser micro these section system shown in fig 1 covers a laser device 4, in the one laser light source to the he

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generation of a laser beam housed is. The other one optics are 6 housed in the laser device 4, which are required, in order to link the laser beam into a microscope 1 and to co-ordinate the laser focus in the object plane with the optical focus of the microscope 1. In the present case it acts for example around a pulsed UVStickstofflaser with a wavelength of 337 Nm, a pulse energy of 270 uJ, a pulse duration of 3 ms and a pulse frequency of 1-30 pulses/second.

To the precise displacement of the laser energy a crystal filter is 5 vertical disposed to the laser beam path, which can become also automatic adjusted over (not shown) a tax panel the corresponding adjustment of the laser energy manual or. Beside the adjustment of the laser energy also the laser focus can become independent by the microscope focus adjusted, D. h. the focal point of the laser can become in z-direction relative the object plane of the microscope 1 shifted, whereby for this purpose the lenses 6 over a stepper motor moved shown in fig 1 to become to be able. Also this displacement can take place both manual and automatic.

The laser beam becomes 12 deflected over several coated beam splitters into the microscope 1 coupled and a lens. The diameter of the laser beam hitting on the object plane is relevant from the numerical aperture of the lens 12 dependent. A

lens with a relative high numerical aperture possible laser beam diameter smaller as 1 over. Besides it should be paid attention to the fact that the used in each case lens 12 exhibits an high permeability for the respective laser wavelength, in order to minimize energy losses.

The laser beam emitted over the lens 12 meets finally on a motorized and a computer controlled

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microscope or inertial table 3, disposed on which a carrier with one is biological material which can be worked on. Above the inertial table 3 is a manual operable or preferably likewise motorized and computer controlled manipulator 2. The components 2 and 3 make an exact object positioning with high precision as well as the automatic execution possible of u-Manipulationsprozeduren.

The motorized inertial table 3 is more movable along two linear axes (x/y direction). At the motorized manipulator 2 for example a needle or a micro pipette can be to the microinjection mounted. In the frame of the current invention however is assumed at the manipulator 2 a collector mounted is, in order to catch biological objects away-catapulted by the carrier.

The motorized manipulator 2 can be proceeded both in x/y direction and in z-direction.

With the microscope 1 it can concern an arbitrary designed microscope. In particular both the use of an inverse and an upright microscope or a laser microscope is more conceivable. With the laser micro these section system represented in fig 1 it concerns an inverse structure, with which the laser beam meets from downside the carrier, in order to catapult on it located biological objects upward to the collector. With an upright structure however the laser beam from above meets the carrier, so that from the biological material extracted objects, in dependence of the laser energy, fall downward on the collector located below the carrier or are catapulted.

The microscope 1 is provided with a video camera, in particular a CCD video camera ("batch coup LED DEVICE"), which takes up the range of the carrier 3 above the lens 12.

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The video signal of this video camera becomes a commercial computer ("personnel computer") 7 supplied and there processed, so that the corresponding video image in real time on the screen or the monitor 8 of the computer can become 7 shown. Likewise is memories of single video images on a suitable storage medium of the computer 7 possible.

The other one also an analogue or digital video recorder can be for noting the video images coupled supplied by the video camera with the computer 7.

As subsequent more near described becomes, is on the computer 7 and/or. by the software running off on it, both the computer-aided, D implements various functions. h. automatic, drive of the laser device 4 and the microscope 1 make possible, so that for example the laser automatic activated and the manipulator 2 and/or. the inertial table 3 automatic to be proceeded can. Likewise these computer-aided functions make a particularly user friendly selection and processing possible of desired biological objects of the biological material located on the carrier. For adjustment and/or. Selection of these functions are conventional input means, as for example a keyboard 9 or a computer mouse 10, provided. The other one is the laser device 4 a foot switch 11 associated, by whose operation of the lasers manual activated can become.

Subsequent ones are to become with shown functions more near explained planned in fig 1 laser micro these section system.

After switching on of the computer on 7 the received microscope picture shown current of the video camera becomes on the screen 8, how it is for example in fig 2 shown. The laser target point 13 is in fig 2 with one

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Cross shown. Beside this microscope picture by software realized adjustment possibilities become for adjustment the laser energy, the laser focus, the laser function, the magnification of the used objective lens 12, for storing the represented microscope picture etc. on the screen. or possibilities to invocations of other menu windows shown, with which in this place is not to be dealt more in greater detail.

The control programme becomes essentially 10 controlled over the computer mouse shown in fig 1, whereby however the substantial functions nen also by corresponding key collective combine IO the keyboard 9 called to become to be able.

Essentially distinguished can become between two different modes of operation.

In the so called cursor mode 10 menus opened, corresponding menu functions selected and so called Buttons can be clicked with the help of the mouse. In the procedure mode however movements of the mouse become 10 direct in corresponding adjustment signals and thus corresponding mechanical movements of the inertial table 3 or the manipulator 2 reacted. Below the microscope picture a status window can become displayed, which and. A. it indicates whether the control current is in the cursor mode or in the procedure mode. this status window can besides X-and the Y-coordinates indicate, which the absolute position (in over) Mikroskopbzw. Inertial table define 3 related to a zero-position.

Apart from the before explained functions additional Grafiktools on the screen 8 shown, with their assistance on the screen, so mentioned to the microscope picture, becomes 8 and/or. in the represented microscope picture draggings or predetermined figs, as for example rectangles, circles, straight lines or ellipses, drawn to become to be able, so that that

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Microscope picture with these graphic elements superimposed on the screen 8 shown becomes. Besides a color palette shown can become on the screen 8, so that can become selected for each drawn element the desired color, which on the screen 8 appears. Those becomes selected color in each case as standard default ("default") for all elements of the current selected type of element stored. In this way it is possible, different biological objects of the biological material 14 located on the carrier 3, which in form Video-bzw. Microscope picture on the screen 8 shown will to select by different colors and to labeled.

With the example represented in fig 2 is assumed the user has biological Objekte-eine free hand section line 16 in a first color, which in fig 2 indicated by a square is placed with the help of the before explained Grafiktools around two. In a second color, which in fig 2 indicated by a circle is, two other objects became marked with the help of corresponding free hand section lines. Three other objects became selected in analogue way by a free hand section line in a third color, which by a triangle indicated is, and/or. marked. In a fourth color, which by a star indicated is, an other free hand section line became finally placed around an other biological object, whereby however is not whole closed contrary to the before explained free hand section lines this free hand section line. The cut lines shown in fig 2 serve not only for the mark and selection of the corresponding biological objects, but for the subsequent Laserbearbeitung on the inertial table of 3 located biological material 14 also as default for the automatic relative movement between the inertial table 3 and the laser beam of the laser device 4, around the laser beam along that

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to lead predetermined in each case cut line and to prepare thus ever weils the selected biological object of the ambient biological mass free.

In the frame of the present embodiment is assumed the different biological objects become 15 marked for the subsequent Laserbearbeitung in different colors, whereby all objects marked in ein-und the same color form a corresponding group of objects.

However other one type of the mark of the single biological objects on the screen is of course 8 possible also apart from the use different colors. So for example like in fig 2 shown can become actualfor each cut line another type of the graph (in fig 2 with a rectangle, a circle, a triangle or a star) selected. Of importance this is concerning only that the mark becomes in such a manner in each case a selected that as significant a discrimination of the single groups as possible, are summarized in which the biological objects with the same mark in each case is possible.

With in fig 2 illustrated example the before explained Grafiktools is in such a manner adjusted that each with a free hand section line 16 marked and/or. selected biological object is provided with a continuous number, which 8 shown on the screen becomes. The biological objects with the number " 1 " and " 2 ", the biological objects with the number " 3 " and " 4 ", the biological objects with the number 5 " - 7 " and the biological object with the number 8 " forms a group of objects thus in each case. The display of these numbers on the screen 8 can be alternatively also deactivated. Beyond that the software of the laser micro these section system covers a function, with which the removal between two can become measured in the microscope picture selected points. So can for example on that

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Microscope picture a starting point selected becomes, whereby automA table the measurement of the removal to this starting point during the movement of the mouse 10 made, if a corresponding mouse button of the mouse becomes 10 pressed held. Likewise the software knows a function to the automatic calculation of the Flä cheninhalts one in before explained way selek tierten and/or. marked biological object, which cut line drawn by egg is 16 limited more ner before, aufwei sen. The area of the respective biological object becomes then for example in pm2 on the screen 8 of the La ser Mikrodissektionssystems shown. As other function the Grafiktools of the laser micro these section system can also exhibit " erasers " - function, in order to delete before in the picture screen of 8 drawn diagram elements again. Likewise a desired text comment inserted can become over a corresponding function at any site of the video image represented on the screen 8.

The before described mark and/or. Selecting the ge biological objects 15 wished serve to select the biological objects desired for the subsequent laser treatment to D. h. those biological objects fixed, which late automatic free-prepared is to be catapulted and/or to the collector, become. For in this way selected biological objects ever weils an entry in a list becomes generated, which 8 shown on the screen becomes likewise. The structure of this reading width unit is to become subsequent more near bottom reference on fig 3 erläu third.

In an upper list section of fig 3 an entry is and/or for each before selected object. an element vorhan that. In gaps a A are the single selected and/or. marked object in the order of their mark analogue to fig 2 durchnummeriert. In gaps a B is for everyone

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Element indicated, which for a type it concerns, where in particular with between a type " LINE " for a cutting line and a type " DOT " for a single catapulting point, which likewise with the predetermined Grafiktools on the video image fixed can become, distinguished becomes. With the example represented in fig 3 it concerns with aluminum len elements marked lines. The other one is in gaps a C for each selected biological object the surface enclosed of the corresponding cut line (preferably in um2) indicated. In gaps a D can sätzlich alternatively become for each entry a corresponding Kom mentar inserted.

As from fig 3 apparent is, is in an other column 18 for each element and/or. for each object with the Selek tion the respective object selected mark or color the indicated.

The list becomes continuous ge on the newest conditions broke. D. h. during the mark other desired bio of logical objects by the user on the screen 8 becomes matisch for each additional marked biological object auto a new entry in the list generated.

In a lower list section 29 is a recapitulatory list shown, in which the objects after object groups and/or. Marks/colors sorted and summarized are. Is for each mark/color in gaps an F the number of the objects contained in each case and in a Spal of width unit G the total area this group of objects of the associated objects indicated. A final line of this list off of cut 29 informs about the total number of the objects of all groups of objects, to D. h. the total number of all marked objects, and their total area.

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With the example represented in fig 3 a selection field is 19 activated, whereby with its activation only listing becomes entries of the type " LINE " shown. Entries of the type " DOT " or also text entries etc. become however with AC tivierung the selection field 19 not shown.

By clicking a Buttons 20 the represented list stored and closed can become. By clicking a Buttons 21 however the list without storing can sen geschlos and become thus discarded. By clicking a Buttons 22 all elements of the list as well as their own shanks (z can. B. Mark/color, number or type etc.) as well as the recapitulatory values into a file to be exported.

A Button 23 possible storing of all elements of the represented list in a file, whereby in particular for each element and/or. for each biological object also the position regarding a before selected reference position of the respective biological material stored becomes. Before storing thus computer-aided this Referenzpo must sition the carrier and/or. the biological material located on it certain become. This reference position is emergency whom dig, over with a renewed use of a slide with already before an examined biological material SI cherzustellen that the there selected and marked bio of logical objects correct started and/or. positioned to become to be able. Can for each slide and/or. for each sample a different reference position certain become. With insertion of the slide the desired biolo gischen objects are then started regarding the before certain Referenzpo sition, D. h. for each element and/or. for each selected biological object stored position data are relative position data, which on the before certain reference position based is. Over a corresponding soft commodity function can of the user with the establishment of the Refe

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renzposition in the represented microscope picture these with the laser in the biological material marked become at the same time, so that a late simple discovery the reference is position possible.

The activation of a Buttons 24 the possible deletion including of licher elements of the represented list, while a Button 28 expenditure-selects only the deletion or several ter elements of the list allowed. By clicking a Buttons 25 the elements of the list new numme remained then can be riert.

With the help of a Buttons 26 each single biological object can be started in such a manner that it appears centered on the screen 8. To the centered illustration of the whether jekts number " 5 " only the corresponding line in the upper list section of fig 3 with the mouse 10 marked and the subsequent must Button 26 activated becomes.

Each single element and/or. each single biological object can become separate with the laser beam machined. If with is to become the spielsweise biological object No. "5 " machined, only the corresponding entry in the upper list off must cut with the mouse marked and a subsequent laser startbutton 30 activated become. Subsequent one rechnerge supports the laser beam by a suitable relative movement between the laser beam and the inertial table 3 by the ge wished and in accordance with fig 2 marked cut line of the respective biological object positioned and along the marked cut line moved, in order the biological to prepare whether jekt free. In analogue way the also several selected biological objects marked and subsequent can be processed by activation of the Laserstartbuttons 30 successively.

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It is from particular advantage however that also in the lower list section 29 a corresponding selection single or several groups of objects of made can become, so that after subsequent activation of the Laserstartbuttons 30 only those the selected group of objects and/or. the selected object groups associated biological objects processed become.

For example if tumor cells in a receptacle and healthy cells in an other receptacle are to become placed, it is advisable in such a manner, during driving off in accordance with fig 2 on the screen of 3 represented microscope picture the desired cells to labeled that the cut left nien the tumor cells in a first color and the cut left nien the healthy cells in a second color drawn becomes. Like that are for example assumed that for the tumor cells the mark the color blue one used becomes, while for the healthy cells the mark the color yellow one whom December becomes. In the lower list section 29 will then a line with a summary of the " blue " tumor cells and a line with the summary of the " yellow " healthy Zel len to appear. By mark of the " blue " line ("High lighting"), corresponding positioning of the receptacle over the laser beam and subsequent activation of the laser starbuttons 30 subsequent all " blue " tumor cells with the laser beam machined and-dependent is catapulted of in a selection field 32 the adjusted Laserfunktion into the receptacle. Subsequent one can become the " yellow " line with the mouse 10 marked, a new receptacle u more ber the laser beam positioned and again the Laserstarbut clay/tone 30 activated, so that in the second Auffangbehäl more ter all " yellow " healthy cells are caught.

Related one is the laser micro these section system advantage detention-proves in such a manner designed that the different receptacles for the single groups of objects and/or whether

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jekte automatic positioned and thus into the catching poetry tion moved become, D. h. before the processing of the objects egg more ner selected group of objects an automatic in each case corresponding receptacle becomes into the reserve position moved, so that the objects become the same group of objects a collected in the same receptacle in each case, which the storage and the subsequent analysis of these objects he light ore.

In the upper list section is beside the gaps 18 an other column 17 provided, in for each element and/or. for each biological object the processing status displayed becomes. As soon as a biological object after activation of the La serstartbuttons 30 with the laser beam machined is, becomes this biological object and/or. this list entry corresponding " check box " marked.

For each activation of the Laserstartbuttons 30 the number of the repetitions of the laser treatment can do 31 einge by input of a respective value into an other selection window will give. With in fig 3 the illustrated example le is diglich a simple execution of the laser function provided adjusted in accordance with the Auswahlfens more ter 32.

How already before short explained is, can with the help of the selection window 32 for each Laserbearbeitung was correct of several predetermined laser functions selected to become. With the laser function "RoboLPC " with activation of the Laserstartbuttons 30 auto, preset in accordance with fig 3, matisch the marked cut line of the respective biolo gischen

object up to a predetermined remaining web abgefah ren and a subsequent separate laser shot on the center of this remaining web set, in order to catapult the desired biological whether out jekt from the ambient biological measures in the up catch container. Became with marking that

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Schnittlinie-wie with the biological object with the No. “8”, shown in fig 2 - the cut line sen as it the width of this remaining web preset in the system would correspond, becomes automatic this off-narrow-continued to read over those mensionierte gap by a straight line on the vorgegebe ne width of the remaining web reduced.

An other laser function " LPC " can be for example to the set zen separate catapulting laser shots provided, D. h. without preceding free preparation will at the desired location a laser shot set, in order to out-catapult corresponding biology sche object. With certain preparation IO, as for example zytozentrifugierten cells nen, can already be sufficient the more ser separate set laser shot to the Herauskatapul animals. An other laser function " cut " can be diglich le for cutting along the marked cut left never provided, without a subsequent Katapul becomes animal laser shot set. The laser shot can become ready then SE at a desired location on the free-prepared biological object with the help of the before explained laser function set. Also with this pure cut radio tion does not become preferably the respective biological object complete free-prepared, but a narrow remaining web of predetermined width is left untouched. An other intended laser function " CLOSE cut " knows that before describing ten cut function to correspond, whereby however the vorge drawn cut line with the laser beam will drive complete abge, in order to prepare the respective biological object complete free. If the cut line of the user did not become completely closed, Start-und becomes end point of the cut line by a straight line of the laser of micro these section system connected, around a closed cut line obtained. An other over the Auswahlfens more ter laser function " AutoLPC " adjustable one can do 32 before in the microscope picture marked surface and/or to the removal. egg

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nes before marked biological object provided its.

With selection of this laser function the range is catapulted within the marked line by a variety by successively set laser shots ablated and into the corresponding receptacle. The number of the laser shots per unit area can become thereby over a corresponding menu of the laser micro these section system adjusted.

An other laser function " CLOSE cut & AutoLPC " plans finally a combination of the two before explained laser functions, D. h. the desired biological object becomes first transported ablated by a variety of successively set laser shots with the help of a complete closed cut line of the ambient biological mass separated and subsequent and into the receptacle. This proceeding is in particular meaningful if the user wants to exclude each risk of a contamination of the biological material which can be cleared away by adjacent biological material.

For each laser phase of operation, D. h. for each activation of the Laserstartbuttons 30, thus the laser function can become over the selection window 32 and the number of the repetitions of this laser function over the selection window 31 adjusted. On the other hand can for each activation of the Laserstarbuttons 30 by corresponding mark of the desired elements and/or. Objects or groups of objects in the represented list selected become whether the corresponding procedure is to extend to single objects or whole groups of objects.

As already before mentioned is, the corresponding " check box " becomes set in the gaps 17 for each machined object, as soon as the processing for this object completed is. The number that becomes in gaps at the same time an E

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for the corresponding object of accomplished cut or catapulting procedures held and shown.

The before explained embodiment of the laser micro these section system possible for example that the biological objects in different way with the laser, summarized in different groups of objects, become machined. So for example only the cut laser function adjusted can be, during for the objects of a second group of objects the " Ro preset in fig 3 boLPC " for the objects of a first group of objects - laser function provided is. In this way a maximum measure at flexibility becomes achieved.